

Claims

- 1 1. An apparatus, comprising:
2 a plurality of flow controllable queues containing data to be transmitted, wherein the flow
3 controllable queues are organized by flow;
4 a plurality of destinations to receive data from the plurality of flow controllable queues;
5 a controller to continually maintain an aggregate count of data ready for transmission to
6 the destinations and determine next queue to transmit data from based at least partially on the
7 aggregate counts.
- 1 2. The apparatus of claim 1, wherein the flow includes at least some subset of
2 source, destination, protocol, and class of service.
- 1 3. The apparatus of claim 1, wherein data is ready for transmission if the associated
2 flow controllable queue is flow controlled.
- 1 4. The apparatus of claim 1, wherein the count for a particular destination includes
2 flow controllable queues associated with the particular destination.
- 1 5. The apparatus of claim 1, wherein the next queue is one of the flow controllable
2 queues associated with the destination having biggest aggregate count.
- 1 6. The apparatus of claim 1, wherein the aggregate count is number of bytes.

1 7. The apparatus of claim 1, wherein the aggregate count for a specific destination is
2 updated to add data queued when data is added to an associated flow controllable queue.

1 8. The apparatus of claim 1, wherein the aggregate count for a specific destination is
2 updated to remove data dequeued when data is removed from an associated flow controllable
3 queue.

1 9. The apparatus of claim 3, wherein the aggregate count for a specific destination is
2 updated to remove data associated with a flow controllable queue if the flow control for the
3 associated flow controllable queue is deactivated.

1 10. The apparatus of claim 3, wherein the aggregate count for a specific destination is
2 updated to add data associated with a flow controllable queue if the flow control for the
3 associated flow controllable queue is activated.

1 11. The apparatus of claim 1, wherein the aggregate count for a specific destination is
2 updated to reflect any changes in associated flow controllable queues.

1 12. The apparatus of claim 11, wherein the changes include any combination of data
2 being added, data being removed, or a flow control change.

1 13. The apparatus of claim 1, wherein said controller updates the aggregate counts
2 each clock cycle to account for changes made to associated flow controllable queues during that
3 clock cycle.

1 14. The apparatus of claim 1, wherein said controller updates the aggregate count for
2 a specific destination by adding data queued in a first associated flow controllable queue and
3 subtracting data dequeued from a second associated flow controllable queue if the queuing and
4 the dequeuing occurred during the same clock cycle.

1 15. The apparatus of claim 1, wherein said controller updates the aggregate count for
2 a specific destination by adding data queued in a first associated flow controllable queue, and
3 adding data contained within a second associated flow controllable queue that became flow
4 controlled, if the queuing and the flow control activation occurred during the same clock cycle.

1 16. The apparatus of claim 1, wherein said controller updates the aggregate count for
2 a specific destination by subtracting data dequeued from a first associated flow controllable
3 queue, and adding data contained within a second associated flow controllable queue that
4 became flow controlled, if the dequeuing and the flow control activation occurred during the
5 same clock cycle.

1 17. The apparatus of claim 1, wherein said controller updates the aggregate count for
2 a specific destination by adding data queued in a first associated flow controllable queue,
3 subtracting data dequeued from a second associated flow controllable queue, and adding data

4 contained within a third associated flow controllable queue that became flow controlled, if the
5 queuing, the dequeuing, and the flow control activation occurred during the same clock cycle.

1 18. The apparatus of claim 1, wherein said controller updates the aggregate count for
2 a specific destination by subtracting data contained within an associated flow controllable queue
3 that had flow control deactivated, if the flow control de-activation was the only event that
4 occurred during a clock cycle or occurred during the same clock cycle as a queuing to the
5 associated flow controllable queue, a dequeuing from the associated queue, or both.

1 19. A method, comprising:
2 creating a plurality of queues based on at least some subset of source, destination,
3 protocol, and class of service;
4 storing data received in a first one of the plurality of queues based on the flow of the data;
5 removing data transmitted from a second one of the plurality of queues;
6 maintaining a continuous aggregate count of data eligible for transmission to the
7 destinations;
8 selecting a next queue to transmit data from based at least in part on the aggregate counts.

1 20. The method of claim 19, wherein the aggregate count for a particular destination
2 includes queues associated with the particular destination.

1 21. The method of claim 19, wherein said selecting includes selecting one of the
2 queues associated with the destination having biggest aggregate count as the next queue.

1 22. The method of claim 19, wherein said maintaining includes totaling number of
2 bytes eligible for transmission to the destinations.

1 23. The method of claim 19, wherein said maintaining includes adding data queued to
2 an associated queue.

1 24. The method of claim 19, wherein said maintaining includes removing data
2 dequeued from an associated queue.

1 25. The method of claim 19, wherein said maintaining includes removing an
2 associated queue that is deactivated.

1 26. The method of claim 19, wherein said maintaining includes adding an associated
2 queue that is activated.

1 27. The method of claim 19, wherein said maintaining includes updating the count
2 each clock cycle to reflect any combination of data being added, data being removed, and flow
3 control change made to associated queues during that clock cycle.

1 28. A store and forward device comprising:

2 a plurality of Ethernet cards to receive, store, and transmit data, wherein the plurality of
3 Ethernet cards include a plurality of ingress ports, a plurality of egress ports, and a plurality of
4 queues;

5 a processor to maintain a continuous aggregate count of amount of data queued for the
6 egress ports;

7 a backplane to connect the plurality of Ethernet cards together; and

8 a scheduler to determine a next queue to service based at least in part on the aggregate
9 counts.

1 29. The device of claim 28, wherein said scheduler selects the next queue based on
2 the egress port having highest aggregate count.

1 30. The device of claim 28, wherein said scheduler selects the next queue per ingress
2 port based on the associated egress port having highest aggregate count.

1 31. The device of claim 28, wherein said processor maintains the aggregate count by
2 updating the count each clock cycle to reflect any combination of data being added, data being
3 removed, and flow control change made to associated queues during that clock cycle.